SPORT FISH INVESTIGATIONS OF ALASKA

Annual Performance Report for
Study No. G-III

LAKE AND STREAM INVESTIGATIONS

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STATE OF ALASKA

Jay S. Hammond, Governor

Annual Performance Report for

POPULATION STUDIES OF GAME FISH AND EVALUATION OF MANAGED LAKES IN THE UPPER COOK INLET DRAINAGE

by

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Volume 20 Study No. G-III

RESEARCH PROJECT SEGMENT

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Project No.: F-9-11

Study No.: G-III Study Title: LAKE AND STREAM INVESTIGATIONS

Job No.: G-III-D Job Title: Population Studies of Game Fish and Evaluation of Managed Lakes in the Upper Cook Inlet Drainage.

Period Covered: July 1, 1978 to June 30, 1979.

ABSTRACT

A brood stock candidate strain of native Alaskan rainbow trout, *Salmo gairdneri* Richardson, from Swanson River demonstrated better first year survival but poorer growth than the imported domestic Ennis, Montana strain when gill net catches and catch rates were compared. Population estimates in two Matanuska-Susitna Valley lakes indicated first year survivals of 42 percent and 23 percent for Swanson fish while survivals for Ennis trout in each lake appeared to be less than 1 percent.

Gill net catches and catch rates revealed better second year survival but poorer growth for stocked Alaskan trout than for Ennis fish. Survival estimates for Age II Swanson River and Talarik Creek, Alaska trout in Marion Lake were 57 percent and 40 percent, respectively.

Minnow trapping in five Matanuska-Susitna Valley lakes one month after stocking produced higher catches of Swanson and Talarik fish than Ennis, although all three strains were planted in equal numbers. Green minnow traps fished in lakes caught much higher numbers of rainbow trout finglerlings per trap hour than did silver traps.

Stomach contents of gill netted Age II Swanson and Talarik trout revealed a disproportionately higher percentage of identifiable newly stocked rainbow trout fingerlings of the Ennis strain than the Swanson or Talarik strains.

Approximately 178 man-hours of effort were expended to finclip 38,000 rainbow trout fingerlings ranging in size from 416 to 554 per kilogram (189 to 252 per pound). Scoring indicated an average of only 2.3 percent of the fish clipped had a 50 percent or better chance of fin regrowth. Samples of Swanson, Talarik, and Ennis fingerlings revealed 9.9 percent, 0.7 percent, and 7.0 percent respectively, had three ventral fins.

A comparison of results between fyke net and gill net catches in Long Lake showed that gill nets caught none of a known sample of 136-155 millimeter (5.4-6.1 inch) fish available for capture.

BACKGROUND

Alaska's lake stocking program makes an important contribution to recreational fisheries within the state, but does not always produce the desired results. A high cost to the creel often occurs due to poor game fish survival which in turn reduces recreational fishing opportunity.

A lake study program designed to provide information for the development of improved stocking practices was initiated in 1973. This study has focused mainly on selected lakes of the Matanuska-Susitna Valleys and is based on the identification and analysis of various limnological parameters and their effects on fish populations.

The early phase of this project concentrated on the detailed collection of physical and chemical data and the identification and relative quantification of various planktonic and invertebrate populations in untreated lakes and in treated lakes prior to, during, and after chemical rehabilitation with rotenone. Findings from the initial investigative phase indicate: (1) A morphoedaphic index (MEI, or specific conductance divided by mean depth) can give a gross measure of relative potential lake productivity and in most cases is easier to determine than the statistically comparable indicies of plankton abundance, periphyton, chlorophyll a, or water chemistry (Chlupach, 1977). (2) Lakes chemically treated with rotenone may require between one and two years to reestablish zooplankton production and three years to attain invertebrate production levels of previous dominance and abundance (Chlupach, 1977). (3) A chemical test for the determination of rotenone in water (Post, 1955) can give a reasonably accurate measurement of residual rotenone concentrations of $\pm$ 0.2 ppm and can be used to detect the presence of rotenone in concentrations at or below 0.2 ppm (Kalb, 1974).

The second phase of this project is concentrating on determining the survival and growth of stocked game fishes in lakes of various limnological characteristics, some of which contain competitor or predator species, or both. To date findings from this research segment indicate: (1) Potential growth of rainbow trout may be restricted in waters infested with stickleback (Kalb, 1975). (2) Survival of rainbow trout appears to be greater in waters where stickleback have been eradicated than in waters where these competitors are present, although in a stickleback environment fish survival is enhanced when relatively larger fish are stocked at lower densities (Chlupach, 1977). (3) Alaskan strains of rainbow trout, taken originally as eggs from wild fish in the Swanson River and in Talarik Creek, show better survival but slower growth than do domestic strains with extensive hatchery backgrounds from Ennis, Montana and Winthrop, Washington (Chlupach, 1978). (4) Rainbow trout of the Swanson strain may have a tolerance to low dissolved oxygen, stickleback competition, and other limnological

parameters as evidenced by consistently better survival (Chlupach, 1978) shown in comparative net catch data (Table 1). (4) Coho salmon in landlocked lakes exhibit significantly greater survival than do domestic strains of rainbow trout (Chlupach, 1978).

These findings, coupled with possible disease importation problems with domestic rainbow trout, have led the Department of Fish and Game toward selection of an Alaskan strain or strains of rainbow trout to serve as the State's rainbow brood stock. Further lake studies are also warranted in order to find: (1) optimum stocking densities for lakes of various fertilities both with and without competitor species, (2) the proper size of fish to stock and time of stocking, (3) which species or strain to stock in lakes of given limnological characteristics, (4) production costs relative to fish survival and subsequent harvest, and (5) sampling equipment and techniques to better assess fish survival and growth at various life stages.

Table 2 lists all species mentioned in this report. Table 3 gives the morpheodaphic index for selected Matanuska-Susitna Valley lakes, and Figure 1 is a map showing the study area.

RECOMMENDATIONS

1. Survival, growth and total yield of Swanson, Talarik, and Ennis strain rainbow trout should be determined in Johnson, Irene, Marion, Big No Luck and Ravine lakes.

2. Time of dispersion and habitat preference should be determined for rainbow trout at time of stocking in Johnson Lake.

3. Swanson strain rainbow trout should be planted in equal densities of 330-550 per kilogram (150-250 per pound) and 1,760-2,200 per kilogram (800-1,000 per pound) in Florence, Irene, Reed, Tigger, Weiner and Johnson lakes to determine survival of each stocking size.

4. Techniques and equipment necessary to determine survival, growth, and yield of stocked game fishes should be developed.

5. Costs to the creel should be obtained for fish stocked in study lakes when harvest estimates are available.

OBJECTIVES

1. To determine survival, growth and total yield of stocked game fishes in landlocked lakes of the area. Major attention will be directed toward evaluating three rainbow trout strains for possible inclusion in Alaska's statewide hatchery program.

Table 1. Stocking and gill net catch data for Swanson, Talarik, and Ennis rainbow trout strains in selected study lakes of the Matanuska-Susitna valleys, 1974-1977.

Lake	Strain*	Date Stocked	Number Stocked	Stocking Size Fish/kg	(lb)	Stocking Density Fish/ha	(a)	Capture Date	Number Caught	Catch/Net Hr. By Strain
Reed	S	10/10/74	1,500	290	(132)	897	(363)	10/2/75	125	1.23
	T	10/10/74	2,578	216	(98)			10/2/75	148	1.48
	T	10/10/74	5,000	216	(98)			10/2/75	253	2.53
Long	S	6/20/75	1,000	24	(11)	136	(55)	10/9/75	83	0.86
	T	6/20/75	3,056	24	(11)			10/9/75	46	0.48
	S	10/5/76	14,800	499	(227)	736	(298)	9/12/77	333	2.83
	E	10/5/76	7,400	262	(119)			9/12/77	11	0.09
Big No Luck	S	10/1/75	4,300	651	(296)	237	(96)	10/9/76	250	3.27
	T	10/1/75	2,200	495	(225)			10/9/76	55	0.72
Canoe	S	10/1/75	2,265	642	(292)	618	(250)	10/13/76	70	0.97
	T	10/1/75	2,625	497	(226)			10/13/76	0	0.00
Irene	S	10/5/76	2,100	499	(227)			9/16/77	176	2.44
	T	10/5/76	2,100	257	(117)	865	(350)	9/16/77	73	1.01
	E	10/5/76	2,100	262	(119)			9/16/77	4	0.06
Kepler	S	9/11/75	8,700	854	(388)	956	(387)	9/16/76	129	1.65
	E	7/21/75	8,700	304	(138)			9/16/76	2	0.03
Ravine	S	10/5/76	1,200	499	(227)	482	(195)	9/18/77	115	1.20
	E	10/5/76	1,200	262	(119)			9/18/77	23	0.24
Matanuska	S	10/4/76	15,000	499	(227)	1,006	(407)	9/12/77	309	3.40
	E	10/4/76	10,000	262	(119)			9/12/77	8	0.09
Knik	S	10/5/76	12,641	526	(239)	620	(251)	10/20/77	442	6.70
	E	5/16/77	20,000	345	(156)	981	(397)	10/20/77	146	2.21

* Strain: S = Swanson; T = Talarik; E = Ennis

Table 2. List of common names, scientific names and abbreviations.

Common Name	Scientific Name & Author	Abbreviation
Rainbow trout	*Salmo gairdneri* Richardson	RT
Coho salmon	*Oncorhynchus kisutch* (Walbaum)	SS
Threespine stickleback	*Gasterosteus aculeatus* Linneaus	TST

Table 3. Morphoedaphic index values for selected lakes in the Matanuska-Susitna Valleys (Watsjold, 1976).

Lake	MEI*	Lake	MEI*
Lucille	23.5	Memory	5.3
Harriet	21.3	Reed	4.9
Canoe	18.1	Meirs	3.4
Talk	16.7	Rocky	3.1
Echo	15.9	Christiansen	1.8
Seymour	14.6	Benka	1.3
Finger	13.3	Loon	1.3
Junction	13.2	South Rolly	1.2
Kepler	11.6	Big No Luck	1.1
Irene	10.4	Twelve Mile	1.0
Long	9.4	Prator	0.9
Victor	9.3	Milo #1	0.7
Knik	9.1	Chicken	0.5
Matanuska	8.2	Byers	0.5
Florence	7.6	Marion	0.4
Johnson	7.4		

* MEI (morphoedaphic index) = conductance divided by mean depth. MEI gives a gross measure of relative potential productivity useful for categorizing and management purposes. MEI values above 13 are most productive, values below three are least productive, while values between 3 and 13 range from moderately low to moderately high in productivity (Chlupach, 1978).

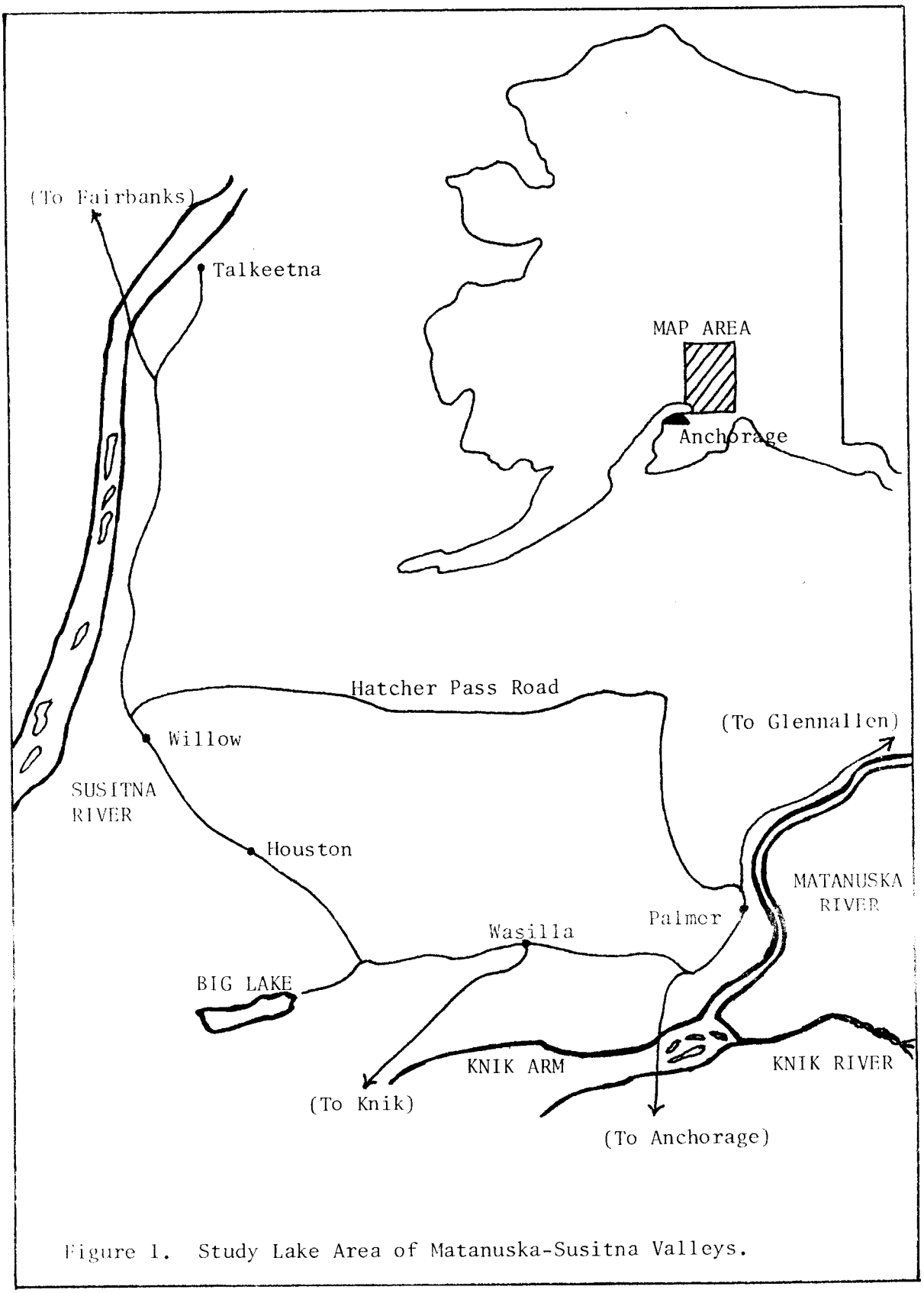

Figure 1. Study Lake Area of Matanuska-Susitna Valleys.

2. To determine limnological conditions that reflect the productivity of study lakes of the area.

3. To provide recommendations for the management of stocked lakes and to direct the course of future studies.

TECHNIQUES USED

Rainbow trout population size in Marion, Florence, and Long lakes was determined by Chapman's modification of the Peterson estimator (Ricker, 1975).

In each lake capture of fish for marking purposes was conducted with fyke net. Fyke nets measured 3.7 m (12 ft) in length and were 1 m (40 in) in diameter and included two 1.2 m X 7.6 m (4 ft X 25 ft) wings. Two square aluminum frames and five aluminum hoops supported the entrance and body of the fyke net. Internal throats, body, and wings were of 9.5 mm (.375 in) square mesh knotless nylon.

All rainbow captured were anesthetized and marked by removing the adipose fin. Marked fish were then enumerated and released with the exception of Long Lake where length measurements were taken. Fish were later captured, using 38.1 m X 1.8 m (125 ft X 6 ft) variable mesh monofilament gill nets composed of five different mesh sizes ranging from 12.7 mm to 50.8 mm (0.5 in to 2 in) bar measure.

Stomachs taken from a portion of fish gillnetted in Marion Lake were placed in a 10% formalin solution and labeled by date of capture. Stomach contents were later examined to determine the presence or absence of recently planted fingerling Ennis, Talarik, and Swanson trout that had identifying finclips.

Catch rates and growth of fish in lakes were also determined by using variable mesh gill nets. Nets were usually fished for 24 hours.

All fish measurements were expressed in fork lengths to the nearest millimeter and in weight to the nearest gram.

Swanson, Talarik, and Ennis strains of rainbow trout fingerlings stocked in all study lakes were first anesthetized, marked at the hatchery by removing either the right ventral, left ventral, or adipose fin, then hand counted into transport tanks for shipment to each lake. Approximately one month after stocking, fish were captured by use of 6.4 mm (0.25 in) square wire mesh minnow traps baited with salmon eggs. In Marion and Big No Luck lakes some of the minnow traps used were spray painted green, while the rest remained the original silver color. All fish captured were recorded as to color of the trap and type of marking and then released.

FINDINGS

Gill Net Catch Rates and Growth of Age I Rainbow Trout

Florence and Long lakes in the Matanuska-Susitna Valleys were chosen to compare survival and growth of Swanson and Ennis rainbow trout strains in waters of medium productivity that contain stickleback, although in 1978, 864 hours of minnow trapping failed to yield any stickleback from Florence Lake, leading to the conclusion that stickleback, if still present, are at a minimum. A few stickleback had previously been captured from the lake in 1977. North Jans Lake in Glennallen was selected to measure relative survival and growth of the two strains in a moderately fertile interior Alaskan lake that contains a remnant stocked coho population. North Joseph Lake was chosen to evaluate trout performance in an infertile Kenai Peninsula lake containing stickleback. Morphometric data for Florence, Long, North Jans, and North Joseph lakes are presented in Table 4.

Gill net catch data for Florence, Long, North Jans and North Joseph lakes are presented in Table 5. A comparison of catch rates in this manner may not be ideal because of differing stocking densities, environments, harvest rates, fish sizes, and sampling dates; however, the overall results indicate the Swanson strain has a greater survival than the Ennis strain. Ennis fish, on the other hand, show superior growth when compared to the Swanson as seen in Table 6.

These results confirm the previous studies by Chlupach (1978) that showed catch rates of stocked wild Alaskan trout ranged from 0.97 to 6.69 fish per gill net hour compared to imported domestic trout catch rates of 0.10 to 0.92 fish per hour. First year growth averages for Alaskan trout were 185 mm and 84 gm versus domestic trout lengths and weights of 224 mm and 171 gm.

First Year Survival of Rainbow Trout

As a direct comparison of survival between wild Alaskan and domestic rainbow trout, population estimates were made for Swanson and Ennis strains in both Florence and Long lakes one year after stocking.

Florence Lake population estimates were made in September, 1978. Three gill nets were fished for a total of 69 hours on September 14 to determine relative survival and fish growth prior to fyke netting. This gill netting resulted in a catch of 424 Swanson fish and two Ennis fish.

Beginning September 18 five fyke nets were fished for a total of 485 hours during which 993 Swanson trout were captured, adipose clipped, and released. No Ennis fish were taken in the fyke nets.

Subsequent gill netting for a total of 296 hours captured 613 Swanson fish, of which 231 had been adipose clipped, and four Ennis trout. The population estimate at the 95% confidence interval for the 1977 Swanson plant (adding in the 424 Swanson fish caught earlier) is as follows:

Table 4. Morphometric data for Florence, Long, North Jans, and North Joseph lakes.

Lake	Surface Area ha	(a)	Maximum Depth m	(ft)	Mean Depth* m	(ft)	Littoral Area** Percent
Florence	22.1	(54.6)	12.5	(41)	5.4	(17.6)	53
Long	30.1	(74.4)	16.8	(55)	8.0	(26.1)	28
North Jans	23.5	(58.0)	9.4	(31)	4.6	(15.0)	40
North Joseph	23.5	(58.0)	14.6	(48)	5.5	(18.1)	50

* Mean depth is volume divided by surface area.
** Littoral area is that portion of the lake less than 15 feet in depth.

Table 5. Stocking and gill net catch data for Swanson and Ennis rainbow trout strains in selected study lakes of the Matanuska-Susitna Valleys, 1977-1978.

Lake	Strain*	Date Stocked	Number Stocked	Stocking Size Fish/kg	(lb)	Stocking Density Fish/ha	(a)	Capture Date	Number Caught	Catch/Net Hr. By Strain
Florence	S	10/3/77	7,333	286	(130)	497	(201)	9/14/78	424	6.14
	E	10/3/77	3,666	227	(103)			9/14/78	2	0.03
Long	S	10/3/77	9,866	286	(130)	492	(199)	10/16/78	440	3.38
	E	10/3/77	4,933	227	(103)			10/16/78	2	0.02
North Jans	S	10/4/77	8,000	288	(131)	512	(207)	9/14/78	163	1.72
	E	10/4/77	4,000	228	(104)			9/14/78	9	0.09
North Joseph	S	10/4/77	4,000	288	(131)	675	(273)	10/10/78	30	0.67
	E	10/4/77	2,000	228	(104)			10/10/78	4	0.08

* Strain: S = Swanson; E = Ennis

Table 6. Length-weight summaries for Swanson and Ennis rainbow trout strains in selected study lakes of the Matanuska-Susitna Valleys, 1978.

Lake	Strain*	Date Stocked	Number Stocked	Capture Date	Number Caught	Length mm		Weight gm		C.F.**
						Mean	Range (in)	Mean	Range (lb)	
Florence	S	10/3/77	7,333	9/14/78	424	195 (7.7)	123-260 (4.8-10.2)	90 (0.20)	18-194 (0.04-0.43)	1.21
	E	10/3/77	3,666	9/14/78	2	296 (11.6)	290-301 (11.4-11.8)	377 (0.83)	364-390 (0.80-0.86)	1.45
Long	S	10/3/77	9,866	10/16/78	440	193 (7.6)	115-285 (4.5-11.2)	87 (0.19)	17-282 (0.04-0.62)	1.21
	E	10/3/77	4,933	10/16/78	2	171 (6.7)	130-241 (5.1-9.5)	68 (0.15)	22-114 (0.05-0.25)	1.36
North Jans	S	10/4/77	8,000	9/14/78	163	222 (8.7)	92-331 (3.6-13.0)	---	---	---
	E	10/4/77	4,000	9/14/78	9	245 (9.6)	195-290 (7.7-11.4)	---	---	---
North Joseph	S	10/4/77	4,000	10/10/78	30	202 (7.9)	152-272 (6.0-10.7)	110 (0.24)	41-263 (0.09-0.58)	1.33
	E	10/4/77	2,000	10/10/78	4	298 (11.7)	242-364 (9.5-14.3)	418 (0.92)	186-781 (0.41-1.72)	1.58

* S = Swanson; E = Ennis

** C.F. = Condition Factor = $\frac{100,000}{L^3} W$

Population Estimate	Survival	95% Confidence Interval Estimates	Survival
3,052	42%	2,733-3,413	37%-47%

Although no such estimate can be made for Ennis fish using this method it may be relative to say that if 1,037 gill netted Swanson equal 34% of the estimated Swanson population then six Ennis equal 34% of the Ennis population, which would equal 18 fish, or a survival of less than 1%.

Florence Lake had relatively little recreational fishing effort and a small remnant population from a plant of Winthrop, Washington strain rainbow trout stocked in 1974.

Long Lake population estimates were made in October, 1978. One gill net was fished for 18 hours on October 2 to determine relative survival and fish size prior to fyke netting. This gill netting resulted in a catch of 35 Swanson and no Ennis fish.

Beginning October 4, five fyke nets were fished for a total of 495 hours during which 1,366 Swanson and one Ennis were captured, adipose clipped, and released.

Subsequent gill netting for a total of 130 hours captured 440 Swanson fish, of which 266 had been adipose clipped, and two unclipped Ennis trout. The population estimate at the 95% confidence interval for the 1977 Swanson plant (adding in 35 Swanson fish caught earlier) is as follows:

Population Estimate	Survival	95% Confidence Interval Estimates	Survival
2,291	23%	2,036-2,577	21%-26%

Although no such estimate can be made for Ennis fish using this method, it may be relative to say that if 475 Swanson fish equal 21% of the estimated Swanson population, then two Ennis fish equal 21% of the Ennis population which would equal 10 fish, or a survival of less than 1%.

Long Lake received considerable fishing pressure and had a relatively abundant population of Age II Swanson strain rainbow trout that were planted in 1976.

Gill Net Catch Rates and Growth of Age II Rainbow Trout

A comparison between stocked wild Alaskan trout and domestic fish at Age II continues to show the superior survival but poorer growth of Alaskan trout. Gill net catch rates are presented in Table 7, while Table 8 gives length-weight data. Catch rates for Swanson and Talarik trout ranged from .07 to

Table 7. Stocking and gill net catch data for Age II rainbow trout in selected study lakes of the Matanuska-Susitna Valleys, 1976-1978.

Lake	Strain*	Date Stocked	Number Stocked	Stocking Size Fish/kg	(lb)	Stocking Density Fish/ha	(lb)	Capture Date	Number Caught	Catch/Net Hr. By Strain
Irene	S	10/5/76	2,100	499	(227)			5/30/78	35	0.15
	T	10/5/76	2,100	257	(117)	865	(350)	5/30/78	16	0.07
	E	10/5/76	2,100	262	(119)			5/30/78	7	0.03
Matanuska	S	10/4/76	15,000	499	(227)	1,006	(407)	5/23/78	77	0.53
	E	10/4/76	10,000	262	(119)			5/23/78	1	0.01
Ravine	S	10/5/76	1,200	499	(227)	482	(195)	6/6/78	61	2.39
	E	10/5/76	1,200	262	(119)			6/6/78	1	0.04
Long	S	10/5/76	14,800	499	(227)	736	(298)	5/24/78	112	0.80
	E	10/5/76	7,400	262	(119)			5/24/78	5	0.04
Marion	S	10/4/76	4,250	499	(227)	185	(75)	9/5/78	616	0.31
	T	10/4/76	4,250	257	(117)			9/5/78	345	0.17

* S = Swanson; T = Talarik; E = Ennis

Table 8. Length-weight summaries for Age II rainbow trout in selected study lakes of the Matanuska-Susitna Valleys, 1978.

Lake	Strain*	Date Stocked	Number Stocked	Capture Date	Number Caught	Length mm Mean	Length mm Range (in)	Weight gm Mean	Weight gm Range (lb)	C.F.**
Irene	S	10/5/76	2,100	5/30/78	35	269 (10.6)	230-315 (9.1-12.4)	223 (0.49)	118-440 (0.26-0.97)	1.15
	T	10/5/76	2,100	5/30/78	16	298 (11.7)	222-367 (8.7-14.4)	317 (0.70)	124-552 (0.27-1.22)	1.20
	T	10/5/76	2,100	5/30/78	7	321 (12.6)	215-365 (8.5-14.4)	497 (1.06)	400-632 (0.88-1.39)	1.50
Matanuska	S	10/4/76	15,000	5/22/78	77	248 (9.8)	178-334 (7.0-13.1)	176 (0.39)	60-482 (0.13-1.06)	1.15
	E	10/4/76	10,000	5/22/78	1	210 (8.3)	---	84 (0.18)	---	0.91
Ravine	S	10/5/76	1,200	6/6/78	61	276 (10.9)	219-365 (8.6-14.4)	245 (0.54)	112-576 (0.25-1.27)	1.17
	E	10/5/76	1,200	6/6/78	1	345 (13.6)	---	580 (1.28)	---	1.41
Long	S	10/5/76	14,800	5/24/78	112	220 (8.7)	136-376 (5.4-14.8)	127 (0.28)	20-622 (0.04-1.37)	1.19
	E	10/5/76	7,400	5/24/78	5	356 (14.0)	312-384 (12.3-15.1)	636 (1.40)	400-816 (0.88-1.80)	1.41
Marion	S	10/4/76	4,250	6/12/78***	50	215 (8.5)	164-265 (6.5-10.4)	108 (0.24)	52-196 (0.11-0.43)	1.09
	T	10/4/76	4,200	6/12/78***	4	285 (11.2)	267-293 (10.5-11.5)	248 (0.55)	206-268 (0.45-0.59)	1.07

* S = Swanson; T = Talarik; E = Ennis

** C.F. = Condition Factor = $\frac{100,000}{L^3} W$

*** Mortalities from fyke-netting.

2.39 fish per gill net hour compared to Ennis catch rates of .01 to .04 fish per hour. Second year growth averages for Alaskan trout were 244 mm and 175 gm versus Ennis trout lengths and weights of 327 mm and 523 gm.

Second Year Survival of Rainbow Trout

As a direct comparison of survival after two years between two brood stock candidates of Alaskan rainbow trout, population estimates were made for Swanson and Talarik strains in Marion Lake.

Marion Lake, surface area 46 ha (113 a) is considered to be of low productivity as compared to other Matanuska-Susitna Valley study lakes. It is free of stickleback; but in addition to the rainbow trout stocked in 1976, has a small population of Winthrop, Washington and Ennis, Montana strains of rainbow trout that were stocked in 1974 and 1975. Marion Lake has no developed public access site and fishing pressure is minimal.

Fyke nets were fished for a total of 864 hours in October, 1977, during which time 131 Swanson fish and 109 Talarik fish were captured, adipose clipped, and released. Gill netting in August, 1977, had removed 56 Swanson and 48 Talarik fish at a catch per net hour of 2.33 and 2.00, respectively. Fyke nets were again fished in June, 1978 for a total of 764 hours during which time 254 Swanson and 29 Talarik fish were captured, adipose clipped and released; 70 Swanson and 7 Talarik mortalities were recorded. The total adipose clipped fish released from the October, 1977, and June, 1978, fyke netting were 385 Swanson and 138 Talarik trout.

Subsequent gill netting in September, 1978, for a total of 2,002 hours resulted in a catch of 616 Swanson fish, of which 102 were adipose clipped, and 345 Talarik fish, of which 28 were clipped.

The population estimate at the 95% confidence interval for the 1976 Swanson plant (including 126 Swanson fish removed earlier) is as follows:

Population Estimate	Survival	95% Confidence Interval Estimates	Survival
2,432	57%	2,026-2,921	48%-69%

The population estimate at the 95% confidence interval for the 1976 Talarik plant (including 55 Talarik fish removed earlier) is as follows:

Population Estimate	Survival	95% Confidence Interval Estimates	Survival
1,706	40%	1,223-2,449	29%-58%

A population estimate was made by Chlupach (1976) in Marion Lake for Age I domestic Winthrop, Washington and Ennis, Montana strain rainbow trout which had been stocked at a density similar to that of the 1976 Swanson and Talarik plant. Winthrop fish had a population estimate at the 95% confidence level of 1,158 and a range of 835-2,161, representing a survival of 7% with an interval of 5%-13%. The population estimate at the 95% confidence level for Ennis trout was 491 with a range of 278-720, representing a survival of 11% with an interval of 6%-16%.

Minnow Trapping of Introduced Rainbow Trout Fingerlings

Minnow trapping approximately one month after stocking equal numbers of Swanson, Talarik, and Ennis fingerlings in five study lakes suggested a greater initial survival of Swanson fish than either Talarik or Ennis fish. All five lakes had remnant populations of older stocked rainbow trout and Big No Luck Lake also contained stickleback. Stocking and minnow trap catch data are presented in Table 9.

These results tend to support findings by Peckham (1974 and 1975) of low initial survivals of stocked imported domestic rainbow trout. Peckham reported a survival estimate of 26% for Age 0 Ennis strain rainbow trout two months after stocking and reported a survival estimate of 18% for Age 0 Winthrop strain rainbow trout two months after stocking.

When green and silver minnow traps were fished in the same lake the green minnow traps caught much higher numbers of rainbow fingerlings per trap hour. In Big No Luck Lake silver traps fished for 936 hours and caught 47 fish for a catch rate of .050 while green traps fished for 456 hours caught 76 fish for a catch per hour of 0.167, or three times as great a rate. In Marion Lake silver traps fished for 612 hours, caught 24 fish for a catch per hour of .039, while green traps fished for 127.5 hours caught 77 fish for a catch per trap hour of 0.604, or 15 times as great a rate.

For comparative purposes minnow traps were also fished in rearing ponds at the Fort Richardson Hatchery. Both Swanson and Ennis fish readily entered baited minnow traps with no substantial difference between the catch per hour of silver traps and green traps.

Miscellaneous Findings

Rainbow Predator and Prey Relationships:

Stomach contents of gillnetted two-year-old Swanson and Talarik rainbow trout revealed a disproportionately high percentage of identifiable newly planted rainbow fingerlings of the Ennis strain. Sizes for Age II Marion Lake fish are presented in Table 8 and sizes for introduced fingerlings are presented in Table 9.

On September 11, 1978 a total of 4,560 left ventral clip Swanson, 3,825 right ventral clip Talarik, and 4,336 adipose clip Ennis rainbow trout fingerlings were stocked in Marion Lake from one access point. Findings of predation of rainbow fingerlings by Age II trout are presented in Table 10.

Table 9. Stocking and minnow trap catch data for Age 0 rainbow trout in selected study lakes of the Matanuska-Susitna Valleys, 1978.

Lake	Strain*	Date Stocked	Number Stocked	Stocking Size Fish/kg	(lb)	Stocking Density Fish/ha	(a)	Capture Date	Number Caught	Catch/Trap Hr. By Strain
Johnson	S	9/7/78	4,000	467	(213)			10/4/78	437	0.374
	T	9/7/78	4,000	416	(189)	736	(298)	10/4/78	88	0.075
	E	9/7/78	4,000	361	(164)			10/4/78	24	0.021
Irene	S	9/5/78	1,200	467	(213)			10/9/78	66	0.096
	T	9/5/78	1,200	416	(189)	494	(200)	10/9/78	21	0.030
	E	9/5/78	1,200	361	(164)			10/9/78	6	0.009
Marion	S	9/11/78	4,560	546	(248)			10/11/78	101	0.121
	T	9/11/78	3,825	396	(180)	279	(113)	10/11/78	63	0.076
	E	9/11/78	4,335	299	(136)			10/11/78	5	0.006
Big No Luck	S	9/6/78	2,250	467	(213)			10/12/78	80	0.057
	T	9/6/78	2,250	416	(189)	245	(99)	10/12/78	37	0.027
	E	9/6/78	2,250	361	(164)			10/12/78	6	0.004
Ravine	S	9/5/78	800	467	(213)			10/10/78	26	0.036
	T	9/5/78	800	416	(189)	494	(200)	10/10/78	19	0.026
	E	9/5/78	800	361	(164)			10/10/78	1	0.001

* S = Swanson; T = Talarik; E = Ennis

Table 10. Predation of rainbow trout fingerlings by Age II Swanson and Talarik rainbow trout strains in Marion Lake, 1978.

Strain	Number Gill-netted	Stomachs Checked	Number of Stomachs Containing Fish	Number of Fingerlings Consumed				Total Fingerlings
				S*	T*	E*	?**	
Swanson	221	93	21	0	1	10	23	34
Talarik	125	52	5	0	0	2	7	9
Totals	346	145	26	0	1	12	30	43

* S = Swanson; T = Talarik; E = Ennis
** ? = Unidentifiable

Marion Lake contains a population of approximately 4,138 two-year-old Swanson and Talarik rainbow trout of which 59% (2,432) are Swanson. Swanson fish represented 64% (221) of the trout gillnetted between September 11 and September 14, 1978. Sixty-four percent (93) of the stomachs checked were Swanson. Eighty-one percent (21) of the stomachs containing fish were Swanson. Seventy-nine percent (34) of the fingerlings were consumed by Swanson. Ninety-two percent (12) of the identifiable fingerlings consumed were Ennis, 8% (1) Talarik, and no Swanson. This may imply that of the three strains planted, Swanson are the least vulnerable to predation and as adults Swanson fish are more aggressive piscivorous feeders than Talarik fish, which could be two reasons why Swanson strain rainbow trout have consistantly exhibited better survival than Talarik or Ennis fish.

Although this cursory investigation may not accurately reflect predator-prey relationships for adult and juvenile trout, it does, however, illustrate the need for additional research into this important subject. If the stomach samples from gillnetted Marion Lake trout represent the predation rate of the overall adult population, it appears possible that about 26% of the Ennis fingerlings were consumed during the 4 days following introduction. This possibility gains added support when one considers that minnow trapping one month later indicated substantially fewer Ennis trout than expected (Table 9).

Gill Net Sampling Bias:

Gill nets (described in the techniques section) caught none of a known sample of 136-155 mm (5.4-6.1 in) fish available for gill netting in Long Lake.

Fyke nets and gill nets were both fished in Long Lake during October, 1978. All fish captured were enumerated and fork lengths recorded. Fish captured in fyke nets were adipose clipped and released. All fish subsequently captured in gill nets were retained. Figure 2 shows the results of the sample nettings. Data indicate gill nets were selective against trout size ranges of 136-165 mm (5.4-6.5 in) and yielded a mean of 196 mm (7.7 in) while the fyke nets tended to more evenly sample available fish in the size ranges of 96-295 mm (3.8-11.6 in) and yielded a mean of 173 mm (6.8 in).

Engel (1972) reported that errors in recording growth and abundance of fish populations appear to be associated with the selectivity of variable mesh nets where smaller mesh sizes have lower catch efficiencies than the larger meshes. Watsjold (1975) found a lack of bias of gill nets on fish populations containing only larger fish but a definite difference in sampling efficiencies on smaller fish among gill nets with various mesh sizes and monofilament diameters.

Rainbow Trout Finclipping:

Finclipping of rainbow trout fingerlings took place at the Fort Richardson and Ship Creek hatcheries in August, 1978, in preparation for stocking selected Matanuska-Susitna Valley study lakes. Approximately 5 days

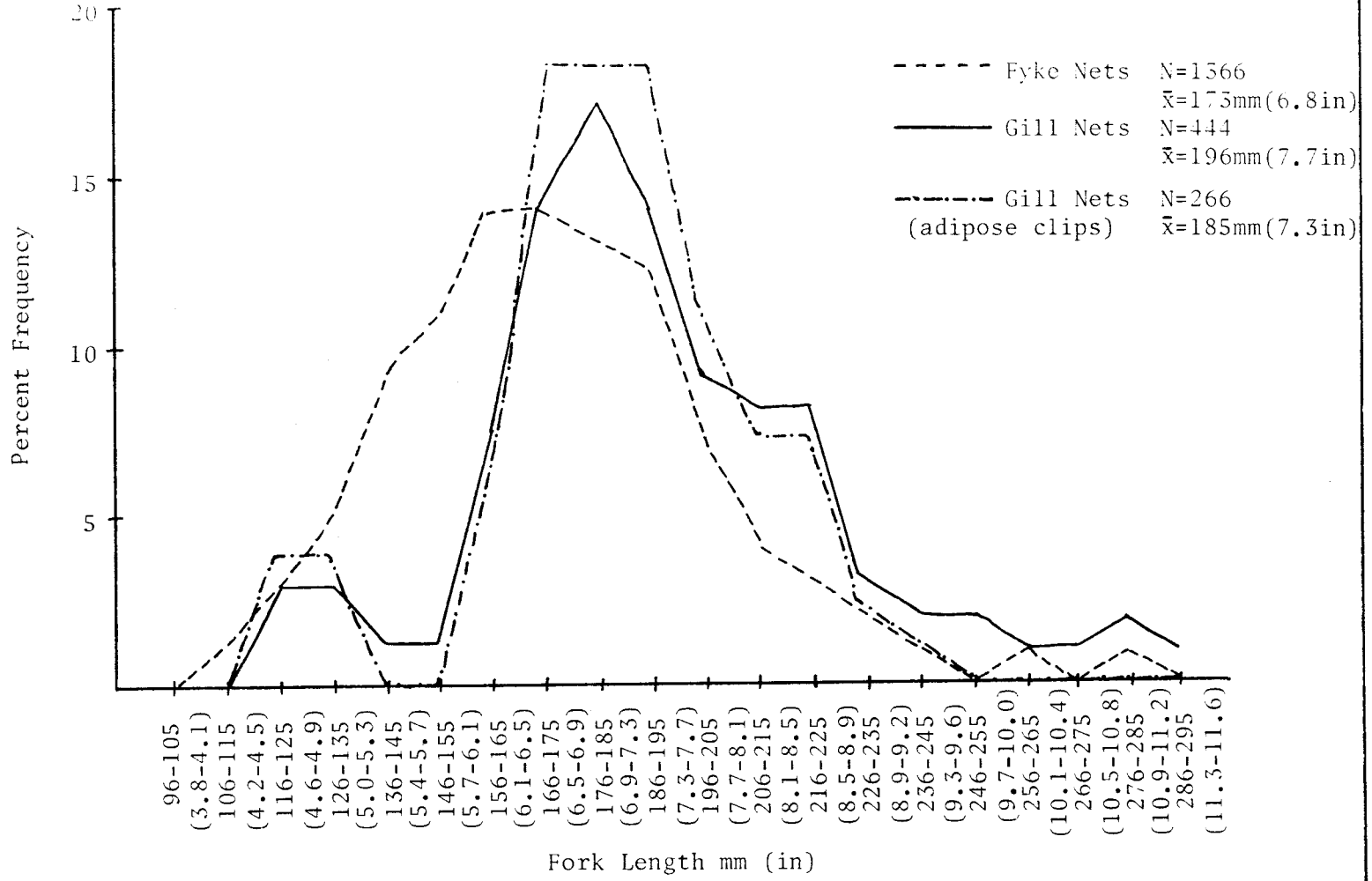

Figure 2. Length frequency by percent for rainbow trout captured by fyke nets and gill nets and adipose clipped rainbow trout captured by gill nets in Long Lake, 1978.

with four people clipping and one person coordinating operations were expended to finclip 38,000 rainbow trout fingerlings ranging in size from 416 to 554 per kilogram (189 to 252 per pound). Another 5 days with three people were spent hand counting clipped fish into hatchery trucks and stocking selected study lakes.

Thirteen thousand Swanson strain rainbow trout fingerlings averaging 554 per kilogram (252 per pound) were left ventral clipped and scoring indicated only 2% of the clips had a 50% or greater chance for regrowth. For 12,500 Talarik fish averaging 416 per kilogram (189 per pound) 5% of the right ventral clips had a 50% or greater chance for regrowth, and for 12,500 Ennis averaging 506 per kilogram (230 per pound) less than 1% of the adipose clips had a 50% or greater chance for regrowth.

It was noted during the clipping process that many of the rainbow trout fingerlings had three ventral fins. A subsequent sample of Swanson strain showed that 9.9% (386) of 3,916 checked had triple ventral fins, 0.7% (4) of 600 Talariks had triple ventral fins, and 7.0% (42) of 600 Ennis examined had triple ventral fins. Most external anomalies, such as multiple fins, are caused by mechanical injury during the egg stage, according to Dr. Gall Geneticist Department of Animal Science, University of California, Davis, (personal communication).

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